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CLOSED CIRCUIT TELEVISION INSPECTION PROGRAM FOR THE LOW LEVEL SEWERSHED

CITY OF BALTIMORE PROJECT NO. 1029

CCTV REVIEW MANUAL

LOW LEVEL COLLECTION SYSTEM EVALUATION AND SEWERSHED PLAN CITY OF BALTIMORE PROJECT 1029

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CCTV DATA REVIEW FOR THE LOW LEVEL SEWERSHED

The Following Conventions Shall Be Used When Reviewing CCTV Data Submitted For The Low Level Sewershed

QUALITY CONTROL (QC) REVIEW

OBJECTIVE: The objective of CCTV inspection program completed for this project will be to internally inspect and evaluate all sanitary sewers 8-inches and larger in diameter and assist in updating the GIS. Where practical the CCTV inspections will be conducted in such a manner that provides an unobstructed view of the complete interior of the pipe being inspected. The National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) was selected by the City of Baltimore for use on this project. The first objective of the PAC Program is to fully document all structural deficiencies and construction features in the sewer segment being investigated since those defects will have a long term influence on the pipe's overall condition and integrity. When the sewer is inspected, the pipe should be free of excessive flow, steam, debris and/or obstructions and provide sufficient lighting that will not impede visibility and allow for a complete inspection and interpretation of the pipes condition. All defects should be coded per the PAC Program guidelines, version 3.0.2 or later. A reasonable effort shall be made by the CCTV contractors to fully inspect the entire pipe segment before the survey is considered abandoned.

QC REVIEW

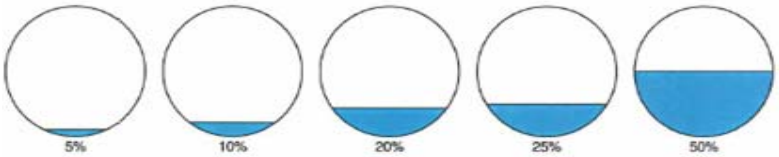
The following issues were considered while reviewing the quality of each CCTV video survey and used to determine if the video was acceptable or unacceptable. They are described in more detail on the following pages.

- Excessive flow
- Poor lighting
- Camera not centered
- Image quality/distortion
- Significant defect not noted
- Excessive camera movement
- Excessive camera speed
- Color
- Overlay problem

CCTV DATA REVIEW FOR THE LOW LEVEL SEWERSHED

Excessive Flow: Excessive flow level in a pipe is described as flow levels that obstruct the inspection camera from providing a clear and unobstructed view/image of the interior of the pipe for evaluation. For the purpose of this project, an inspection will be considered acceptable if the inspection camera proceeds in excessive flow (sag in a pipe) for short distances assuming the pipe before and after the sag is in serviceable condition. Inspections will not be accepted when a CCTV camera operator attempts to turn the inspection camera to the side or attempts to ride-up the side of the pipe to keep the camera above the flow line. If the pipe dips underwater at any point during the survey an "MCU" code should be noted and if the camera is underwater for more than 10% of the total length of the pipe being surveyed, the survey should be failed and marked as "Excessive Flow". The following criteria is outlined in the PACP manual and shall be used for determining acceptable and unacceptable flow conditions in a pipe segment during the inspection process:

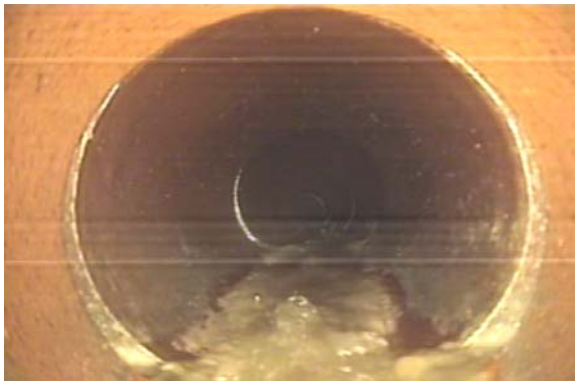
Pipe Size	Maximum Depth of Flow
6" to 10" Pipe	No More Than 20% of the Pipe Diameter
12" to 24" Pipe	No More Than 25% of the Pipe Diameter
24" And Up	No More Than 30% of the Pipe Diameter



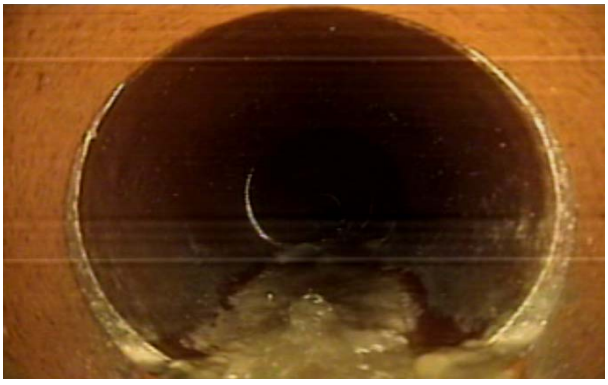
Acceptable Flow Level (Flow Below Camera)

Unacceptable Flow Level (Can't See Entire Pipe)

Poor Lighting: Lighting during the inspection should be adequate to fully illuminate the entire pipe section in view of the CCTV camera, but not over illuminate the image where as to create distortion of the image. Low lighting will likely occur in larger diameter pipes or when dark pipe materials such as HDPE, DIP, etc. was used in the construction of the system. In order for an inspection to be considered acceptable, the complete interior of the pipe must be visible to detect and code all defects, etc.



Acceptable Lighting For Inspection



Unacceptable Lighting For Inspection

CCTV DATA REVIEW FOR THE LOW LEVEL SEWERSHED

Camera Not Centered: In order to provide a complete and unobstructed view of the pipe for inspection, the camera must be appropriately sized and centrally positioned to adequately view the complete interior of the pipe being inspected. This means the camera should be centered both vertically and horizontally in the pipe being inspected and the complete interior of the pipe must be visible for inspection.

Camera/Image Not Centered

Camera/Image Adequately Centered

Image Quality/Distortion: In order to provide a complete and thorough inspection of the pipe, the inspection camera must provide an image that is clear and not distorted by flow levels, water, steam or debris on the camera's lens. The camera must be centered in the pipe so as not to exaggerate the image (i.e. amount of offset in joints, pipe ovality, etc). The image must be clear and allow for a thorough visual inspection and interpretation of the interior of the pipe.

Clear/Acceptable Image Quality

Distorted/Unacceptable Image Quality

CCTV DATA REVIEW FOR THE LOW LEVEL SEWERSHED

Significant Defect Not Noted: A Significant Defect Not Noted (PACP Structural, O&M, Construction & Miscellaneous Features) should be defined as a defect that has not been recorded as part of the inspection but impacts the structural condition of the pipe or requires system maintenance. These include structural defects such as cracks, holes, offset joints, roots, etc. and maintenance related items such as grease and debris. These defects should always be coded per the PAC Program requirements. Note: some of the PAC Program codes contain threshold limit values such as joint offsets and defects. Other defects may require judgments by the observer/reviewer whether to code or not. Defects that appear to be only cosmetic in nature and DO NOT impact the structural integrity or the operation of the sewer do not require coding. As a general rule, if more than 3 significant defects are not coded, then the inspection should be rejected.

Examples of Significant Structural Defects That Should Be Noted:

Cracked Pipe (C): Longitudinal (CL), Circumferential (CC), Multiple (CM)
Fractured Pipe (F): Longitudinal (FL), Circumferential (FC), Multiple (FM)
Broken Pipe (B)
Hole in Pipe (H)
Deformed Pipe (D): Vertical (DV)
Collapsed Pipe (XP) / Brick (XB)
Joint Offset (JO), Joint Separated (JS), Joint Angular (JA),
Surface Damage (S): Reinf. Visible (SRV), Reinf. Projecting (SRP), Reinf. Corroded (SRC), Missing Wall (SMW)
Lining Failure (LF)
Missing Mortar (MM)
* Use of Continuous Defect Coding: A continuous defect is any defect that extends or is repeated beyond the first 3-feet of the camera's position or when at least 75% of the joints (3 out of 4) are affected in a pipe.

Examples of Significant Operational and Maintenance Defects That Should Be Noted:

Deposits - Attached (DA), Deposits - Settled (DS)
Roots (R): Fine (RF), Tap (RT), Medium (RM), Ball (RB)
Infiltration (I) - All Types
Obstacles/Obstructions (OB) - All Types

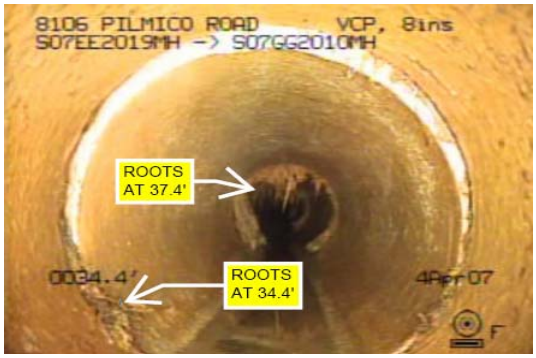
Examples of Significant Construction Feature Defects That Should Be Noted:

Tap (T), Intruding (TI), Defective (TFD), Break-in / Hammer Conn. (TB)

Examples of Significant Miscellaneous Features Defects That Should Be Noted:

Miscellaneous Shape Change (MSC)
Mean Water Level - Sag (MWLS)

Example of PACP Coding Error

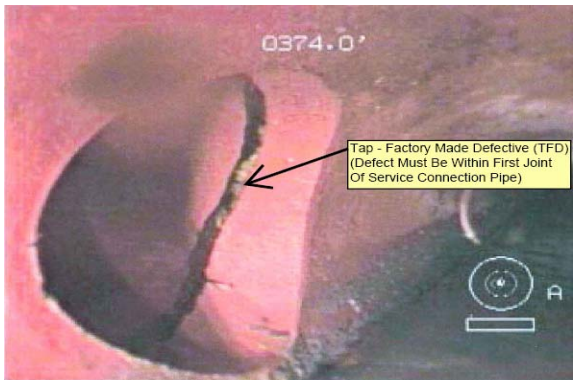


Significant Defect (Roots) In Pipe Not Noted

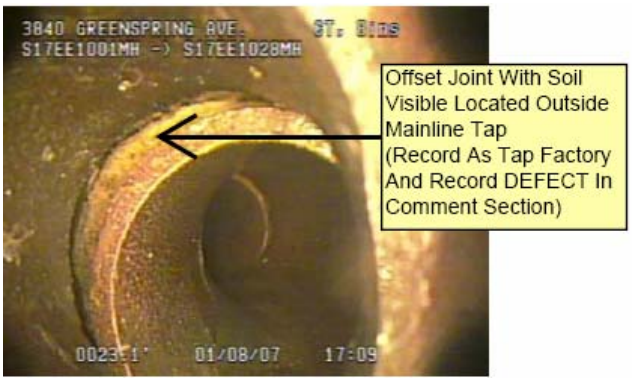
0.0		ST						
0.0		AMH						
0.0		MWL			5			
3.1		MWLS			10			
10.8		RFJ					03	
13.1		RFJ					08	04
16.6	S01	RFJ					03	
20.6		H				J	03	
55.6		TFA	6.0				03	
73.7		TFA	6.0				03	
92.0		JOM						

DEFECTS NOT NOTED: ROOTS AT 34.4' & 37.4' (RFJ)

Significant Defect (Roots) Not Noted



Example of Tap - Factory Made Defective (TFD)



Example of Defect Located Outside Tap - Factory Made (Code as TF - Then Indicate In Comment "DEFECT")

Continuous Defects – Coding

Enter distance the defect starts

Enter defect code and any other associated information i.e. clock reference

Enter continuous defect number

Distance (feet)	Video Ref	Code		Continuous defect	Value				Joint	Circumferential location	
		Group / Descrip	Modifier / severity		S/M/ L	Inches 1st	Inches 2nd	%		At / from	To
36.0		IR		S 01					J	08	04
89.7		IR		F 01					J	08	04

Remember to close all defects including all associated details

Continuous Defect Coding - If a Continuous Defect Is Started (S 01) It Must Be Closed (F 01)

CCTV DATA REVIEW FOR THE LOW LEVEL SEWERSHED

Excessive Camera Movement: The CCTV camera should always be centered in the middle of the pipe and the camera head not excessively panned or zoomed during the inspection. The camera should be stopped and centralized on defects while the operator views and records the defects. The operators objective in positioning the camera should be to provide a perspective similar to that found in the PAC Program reference manual.

Acceptable Image - Centered In Pipe

Unacceptable Image - Image Rotated To Side

Excessive Camera Speed Is Described As: The CCTV camera should always be centrally located in the middle of the pipe being inspected and should not exceed 30-feet per minute in forward progression.

Image Color: The CCTV camera should record all inspection images in color allowing the observer to review details of the inspection. Color images allow the observer to determine items such as pipe material, lining installation, severity of defects, etc. which otherwise could not be detected with a black and white image. Any inspections completed in black and white will not be accepted.

Acceptable Color Inspection

Unacceptable Black & White inspection

Overlay Defects: All video overlay images shall be clearly visible to the reviewer and include all PAC Program defined items. Overlay color that is not clearly visible over the image will not be acceptable. The camera length image shall always be visible by the reviewer so defect locations can accurately be noted.

Acceptable Overlay (Entries Can Be Seen)

Unacceptable Overlay (Entries Can't Be Seen)

CCTV DATA QA/QC FORM FOR THE LOW LEVEL SEWERSHED

The Following form shall be used when reviewing CCTV data submitted for the Low Level Sewershed

Review results shall be recorded in the following spreadsheet. As shown in the spreadsheet, the length of each surveyed sewer will be compared to the corresponding sewer in the GIS database and discrepancies will be investigated by comparing the CCTV database with the GIS. Reviewers will also verify inspection data against GIS data for location and upstream and downstream manhole numbers.

CCTV Surveys List

Setup	DATE	Street	Start MH	Finish MH	Dir	Size	Pre Clean	Media Number	Scheduled Length	Surveyed Length	REVIEWER	DATE	Do street address & location details of inspection location match location shown in GIS?	Do US & DS MH numbers agree with GIS?	Are MH numbers entered correctly?	Does survey have a corresponding mpg file?	Is defect and observation coding good?	COMMENTS
								Total Scheduled Length										
								Total Length Surveyed										
							HC/T											
							LC/T											
							Cont/ CCTV											